

## LETTERS TO THE EDITOR

### Anabolic Steroid-Induced Echocardiographic Characteristics of Professional Football Players?

We read with great interest the study by Abernethy et al. entitled "Echocardiographic Characteristics of Professional Football Players" (1). The investigators report on a high relative wall thickness of 0.424, reflecting an emphasis on strength training.

Although the investigators state that "steroid use among the participants was not known," no data are presented to underline this important statement, nor is the possibility of an anabolic steroid-induced hypertrophy discussed. It is well known that anabolic steroid use is not uncommon among professional football players as the National Football League does not perform doping tests as required by the World Anti-Doping Agency (WADA) among professional athletes of most other sports. To prove the investigators' statement of having examined steroid-free football players, a screening test for doping substances could have been performed, or at the least parameters of clinical chemistry which are altered by the use of anabolic steroids (e.g., follicle-stimulating hormone, luteinizing hormone, sex-hormone binding globulin, cholesterol, low-density lipoprotein, high-density lipoprotein, alanine aminotransferase) should have been given in the paper. The researchers also do not present data on diastolic function, which may be restricted in anabolic steroid users and thereby contribute to a differentiation between a physiological and pathological myocardial hypertrophy (2–5). Furthermore, a description of the athletes' training history (years of training, hours per week spent for strength training) would have been helpful.

As reported previously, the relative wall ratio in anabolic-free soccer players, rowers, weightlifters, and bodybuilders usually is about 0.40 and differs significantly from higher values in anabolic steroid-using bodybuilders (5). This influence of anabolic steroids on the left ventricular wall has also been demonstrated by others (2–4,6). Additionally, the cited study of Pelliccia et al. (7) found a left ventricular wall thickness of  $\geq 13$  mm in only 1.7% (15 rowers or canoeists and 1 cyclist—each of them having a left ventricular end-diastolic diameter  $> 54$  mm) in 947 athletes, whereas Abernethy et al. (1) present about 28% of the football players having a left ventricular wall thickness of  $\geq 13$  mm in their Figure 2, but they only mention 11% (17 of 156) with *more* than 13 mm in the Results section, which are cited as 6% in the Discussion section of their study (1).

Furthermore, Abernethy et al. (1) do not cite their used echocardiographic convention and probably determined myocardial wall thickness by the Penn-Convention (8) (otherwise the use of the Penn-Cube formula [8] for left ventricular mass determination is not admissible). Because the Penn-Convention (8) excludes the epi- and endocard from septal and posterior myocardial wall thickness, an underestimation compared to the data of Pelliccia et al. (7), who determined the myocardial wall thickness by use of the convention of the American Society of Echocardiography (9), has to be presumed.

Therefore, we do not share the opinion that the data presented allow for the conclusion that a strength-training-induced high relative wall thickness in professional football players reflects a physiologically induced (concentric) hypertrophy.

Jürgen Scharhag, MD  
Axel Urhausen, MD, PhD, FACSM  
Wilfried Kindermann, MD, PhD

Institute of Sports and Preventive Medicine  
University of Saarland  
Campus, Building 39.1  
66123 Saarbrücken  
Germany  
E-mail: j.scharhag@mx.uni-saarland.de

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## REPLY

Dr. Scharhag and colleagues raise the important point that steroid use among the athletes may have affected echocardiographic features of presumably healthy elite football players. Anabolic steroids are commonly used to enhance athletic performance and muscle development and may have deleterious effects. Hypertension, ventricular remodeling, myocardial ischemia, and sudden cardiac death have each been temporally and causally associated with anabolic steroid use in humans (1). However, studies examining the effects of anabolic steroids on myocardial structures have not been consistent, and the topic remains controversial (2,3). Surveys of U.S. football players at the high school level suggest that more than 6% had used anabolic steroids (4). However, even though we were unable either to question the participants or to perform blood tests for steroid use as part of our study, National Football League (NFL) players are subject to year-round testing. Therefore, it would be very difficult for them to use these substances.

The number of subjects with thickened ventricular walls is correctly shown in the histogram of Figure 2 of our report. Actually, 30% (47 of 156 subjects) had a wall thickness  $\geq 13$  mm. The statement in the Discussion section of our report that "six percent of the football players in our series had a wall thickness in